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North American Census of
Small Mammals

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Population Dynamics of Vertebrates

Release No. 10

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# Revised Sampling Procedure for the North American Census of Small Mammals (NACSM)

John B. Calhoun, Editor

Administrative Publication
U. S. Department of Health, Education, and Welfare
Public Health Service
National Institute of Mental Health
Bethesda 14, Maryland

NATURAL HISTORY SURVEY
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# Preface

One facet of many problems in basic and applied biological research is that of population dynamics. Solution of these problems demands an understanding of the principles involved.

During the years 1948-1958 a number of investigators scattered over North American have cooperated in contributing results of censuses of small mammals, primarily mice and shrews. All cooperators have utilized a common sampling procedure. Their results have been printed and distributed as Releases 2-9 of the North American Census of Small Mammals. This availability to each cooperator of the results of all cooperators has enabled development of insights into the organization of populations not possible through the effort of a single individual.

Also during the years 1948 to 1958 many cooperators engaged in other types of studies in conjunction with their standardized NACSM censuses. These parallel studies have had two major consequences. They pointed up certain inadequacies in the then current sampling procedure. Furthermore, they have indicated a remarkable social organization within and among genera. If preliminary indications can be substantiated and elaborated, this further understanding of the social organization of this relatively simple community promises to provide insight into both the evolution of the nervous system and of social behavior.

The immediate objective during the next two years is to accumulate censuses of small mammal communities by a procedure which will at the same time provide a picture of the relative numbers of the several species comprising the small mammal community, and of the social relations within and among species with regard to their spatial distribution. The National Institute of Mental Health sponsors the compilation and distribution of such data because of its potential contribution toward an understanding of forces which mold the life of the individual.

This release is an administrative publication of the National Institute of Mental Health. It is not intended for listing in publication catalogs as available for general distribution upon request. It has been prepared in small quantity for distribution to current cooperators, as well as to potential cooperators who wish to decide if they are in a position to participate in this more complex development.

Cooperators should contact John B. Calhoun, Room 2N-310, Building 10, National Institute of Mental Health, Bethesda 14, Maryland, for forms suitable for supplying data on censuses taken. When completed they should be returned to him.

# Revision of NACSM Sampling Procedure

## Former Procedure:

From 1948 to 1958 the NACSM sampling procedure consisted of a trap-line of 20 stations, 3 traps per station, and all stations run for three consecutive days. Customarily two parallel trap-lines were run simultaneously. Lines with a 50-ft. interval between stations were designated as B-type lines, and lines with a 25-ft. interval were designated as A-type lines.

## Revised Procedure:

The revised procedure has many similarities to the former one. It is as if one "stood" between two parallel NACSM trap-lines and pushed the centers of the trap-lines farther apart and then "reached out" and pulled corresponding ends toward each other. Such modification results in a circular trap-line. It will contain 40 trapping stations with three traps at each station.

All stations are to be run for 30 consecutive days. Where the 50-ft interval between trapping stations is used, place the three traps within a five foot radius of the station marker; and within a 2-1/2 ft. radius where the 25-ft. interval between stations is used. Where the habitat makes surveying a circular trap-line somewhat difficult, cooperators may wish to utilize an octagonal trap-line, which for all practical purposes is circular. In order to facilitate comparison with existing data on parallel trap-lines, an identical system of numbering stations will be used. Stations will be numbered in a clockwise fashion starting at the North Station. The East 20 stations will be designated as Line I and the West 20 stations as Line II. See attached diagram.

Summary of Circular or Octagonal Trap-Line of 40 Stations

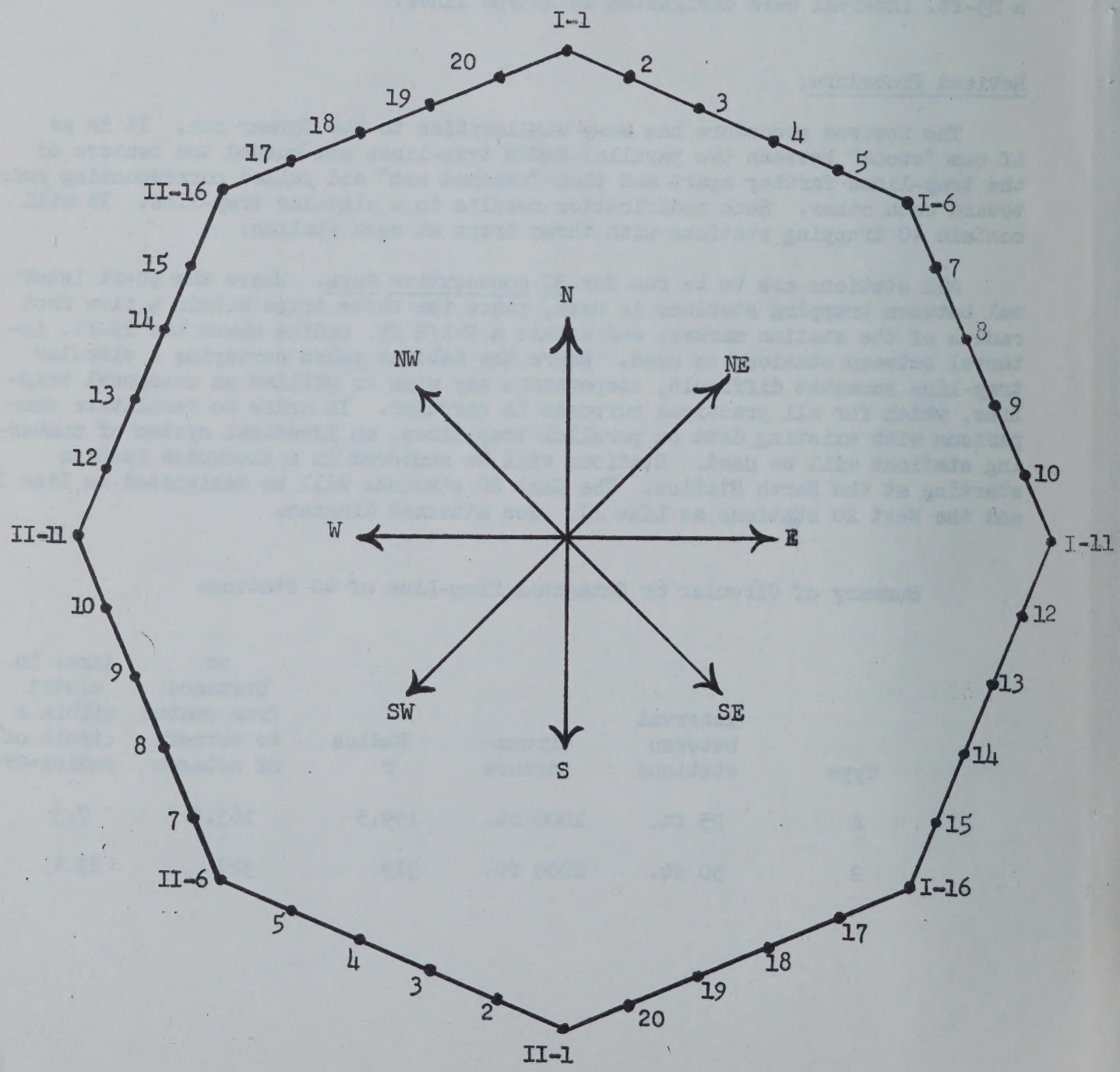
| Type | Interval between stations | Circum-ference | Radius r | or Distance from center to corners of octagon | Acres included within a circle of radius=2r |
|---|---|---|---|---|---|
| A | 25 ft. | 1000 ft. | 159.5 | 163.5 | 7.3 |
| B | 50 ft. | 2000 ft. | 319 | 327 | 29.4 |

Figure 1

NACSM CONTINUOUS REMOVAL (30 - DAYS)

TRAP-LINE (3 TRAPS PER STATION)

(For use in removal trapping only.)



The last column represents the minimum circular areas in which the circular trap-line should be set. Where possible utilize the B type circular trap-line.

If you have previously run the parallel type straight NACSM lines locate the center point about which the circular trap-line is to be oriented by making it at the center of the rectangle subtended by lines connecting Stations I-10, I-11, II-10 and II-11 of the former parallel lines.

Reporting Data:

Description of the habitat follows the former procedure. Report any remarks on the weather at the beginning of each day's Daily Catch Record.

Use as many Daily Catch Record sheets as are necessary to report all captures for the 30 days. Do not start each day's record on a separate sheet. If one day's record ends in the middle of a page merely draw a red line under the last animal posted and start the next day's record on the next line.

At your own discretion list measurements of weight and length of body. Depending upon the volume of reports received it may be necessary to limit printing results in future releases to Day, Line, Species, Sex, and Station.

In addition to the detailed Daily Catch Record, please fill out the table (for days 1-30) summarizing the total catch by day, species and sex.

Background for Revised Procedure:

During the course of the history of the North American Census of Small Mammals several persons have run groups of traps for 15-80 days. The NACSM paired trap-lines were used in some cases, whereas some cooperators experimented with several other patterns of setting traps.

In any case the total number of animals taken was much greater than that taken during the first three days. Originally (Science, 117: 358-360, 1953) it was thought that invasion was responsible for this later impact. Some unpublished studies by Drs. Webb and Patric at the Huntington Wildlife Forest in New York suggest that invasion may occur with certain species, but usually not until after 21-30 days have elapsed.

Before commenting further it will be best to examine the results of six typical continuous removal studies shown in the accompanying figures and tables. It will be noted that the genus which is most abundantly represented in the first three-day capture record, customarily turns out not to be as abundant in the thirty-day total as some other genus, not so abundantly represented in the first three-day catch record.

In time it may be possible to determine precisely the origin of these peculiar results. The very rough notion at present is that there is normally a dominant genus in the small mammal community. Its members have large home

ranges and so exhibit a high probability of exposure even to widely dispersed traps. Prior to removal of this "dominant genus" its members in some way exhibit an inhibitory influence upon the members of some second and thus subordinate genus. The response of the members of this subordinate genus is to contract their home ranges. In some cases the home ranges become so contracted that the probability of one placing a trapping station within a home range is so low that few if any are trapped within three days.

However, as members of the dominant species are trapped off the resultant diminuation of inhibitory influences permits the members of the subordinate species to enlarge their home range to the point where they also are exposed to traps.

Considerable other data is at hand which supports this general formulation. Even if this explanation proves to be incorrect it is obvious that the small mammal community presents an intriguing problem. To understand it we must bring to bear on it concepts from ecology, physics, sociology and psychology.

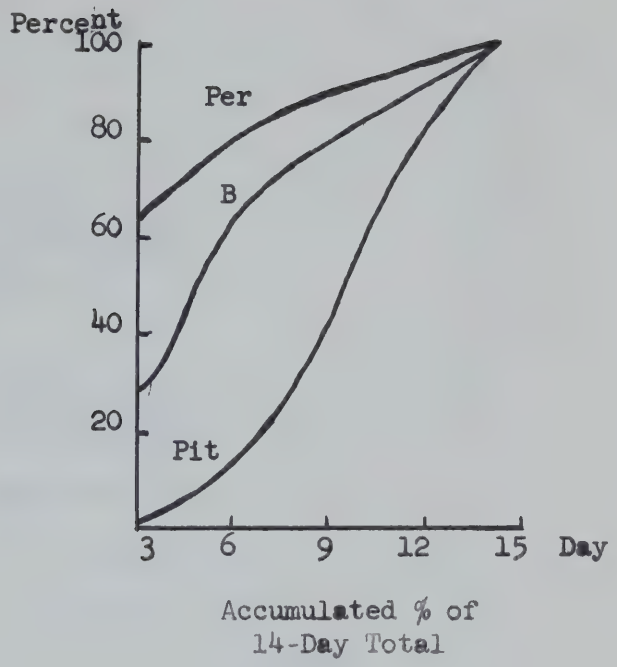
But for the present we need a body of empirical data to provide us with some insight into the variability in composition of the small mammal community. We need to know the time course of change in rate of capture of the several species present. In terms of initial size of home range, as indicated by initial rate of capture, it looks as though dominance of genera falls into the following series: Clethrionomys > Peromyscus > Blarina > Pitymys > Sorex.

Preliminary analyses of the three-day sequence of captures included in the 1948-1958 NACSM reports suggest that the degree to which one genus inhibits another is, in some cases, partially dependent upon the relative abundance of the two genera. For example we may consider the Clethrionomys-Peromyscus relationship:

Figure 2

Mixed Upland Forest
Montgomery Co., Md., 1953
Dr. John B. Calhoun

| Genus | Total Catch 3-Day | 14-Day |
|---|---|---|
| Per=Peromyscus | 29 | 45 |
| Pit=Pitymys | 1 | 62 |
| B=Blarina | 23 | 76 |

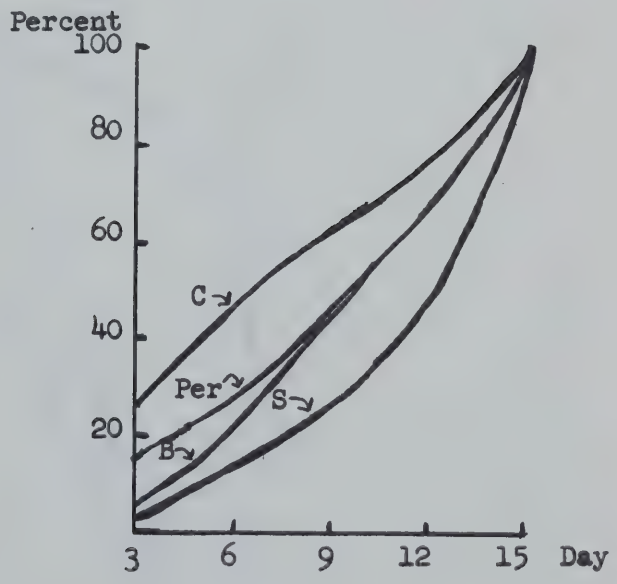



Accumulated % of
14-Day Total

Figure 3

Birch-Spruce-White Cedar
Mt. Desert Island, Maine, 1950
Mr. A. Dexter Hinckley

| Genus | Total Catch 3-Day | 15-Day |
|---|---|---|
| C=Clethrionomys | 20 | 80 |
| Per=Peromyscus | 12 | 75 |
| B=Blarina | 8 | 132 |
| S=Sorex | 1 | 53 |

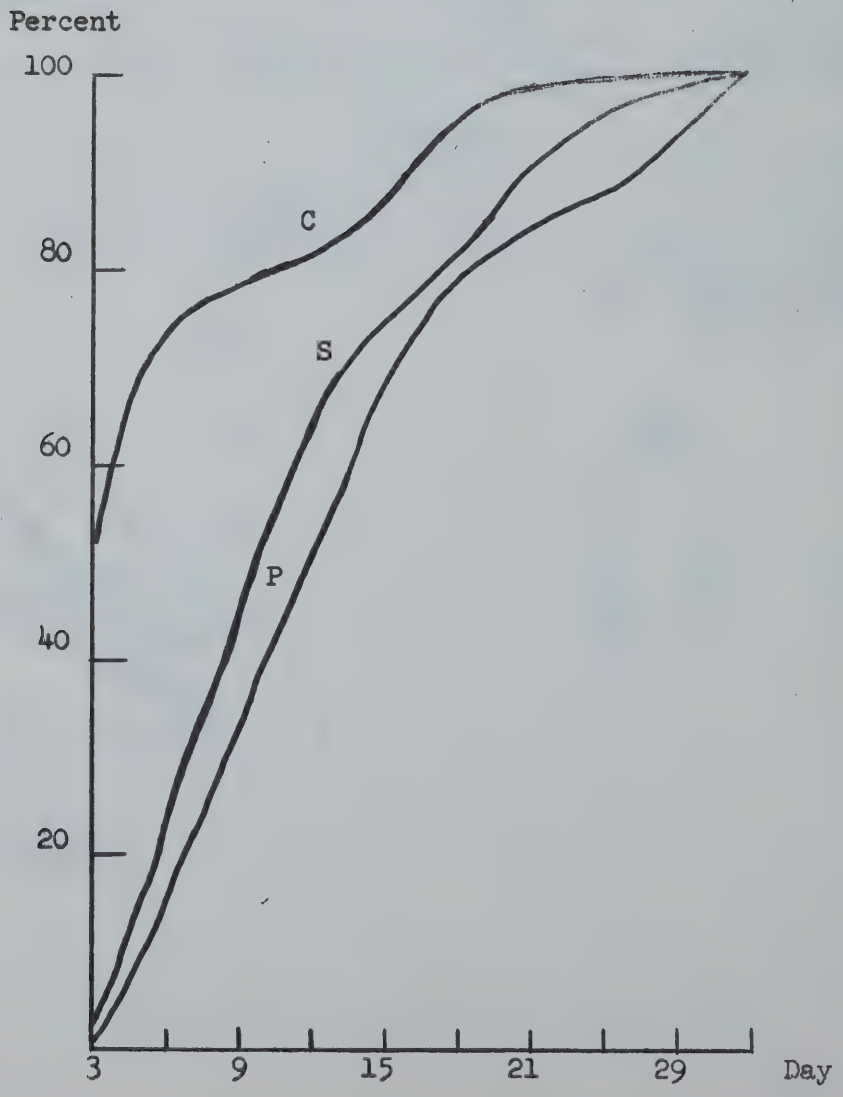



Accumulated % of
15-Day Total

Figure 4

Huntington Forest
Rich Lake Island, N. Y. - 1952
(30 Acres)
Dr. William L. Webb

| Genus | Total Catch 3-Day | 30-Day |
|---|---|---|
| C = Clethrionomys | 53 | 97 |
| S = Sorex | 4 | 204 |
| P = Peromyscus | 0 | 19 |

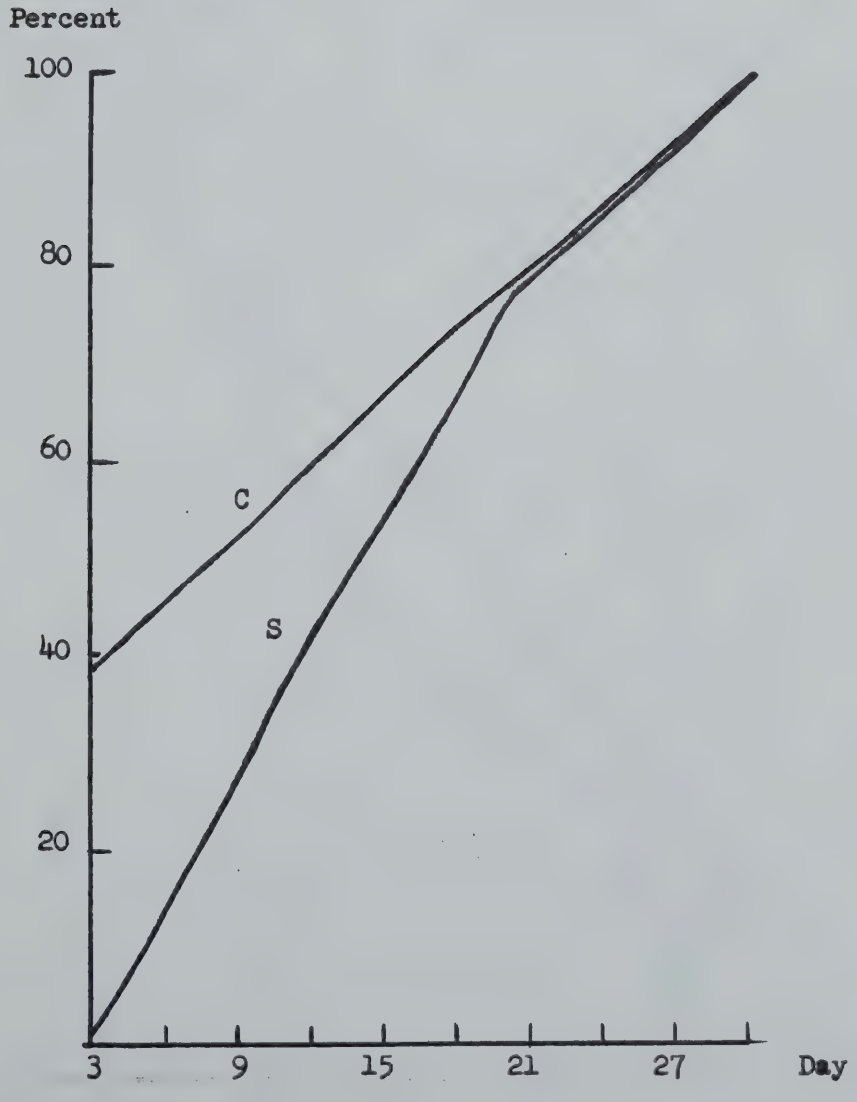



Accumulated % of 30-Day Total

Figure 5

Huntington Forest
Arbutus Area, N. Y. - 1953
Dr. Earl Patric

| Genus | Total Catch 3-Day | 30-Day |
|---|---|---|
| C = Clethrionomys | 33 | 86 |
| S = Sorex | 0 | 56 |

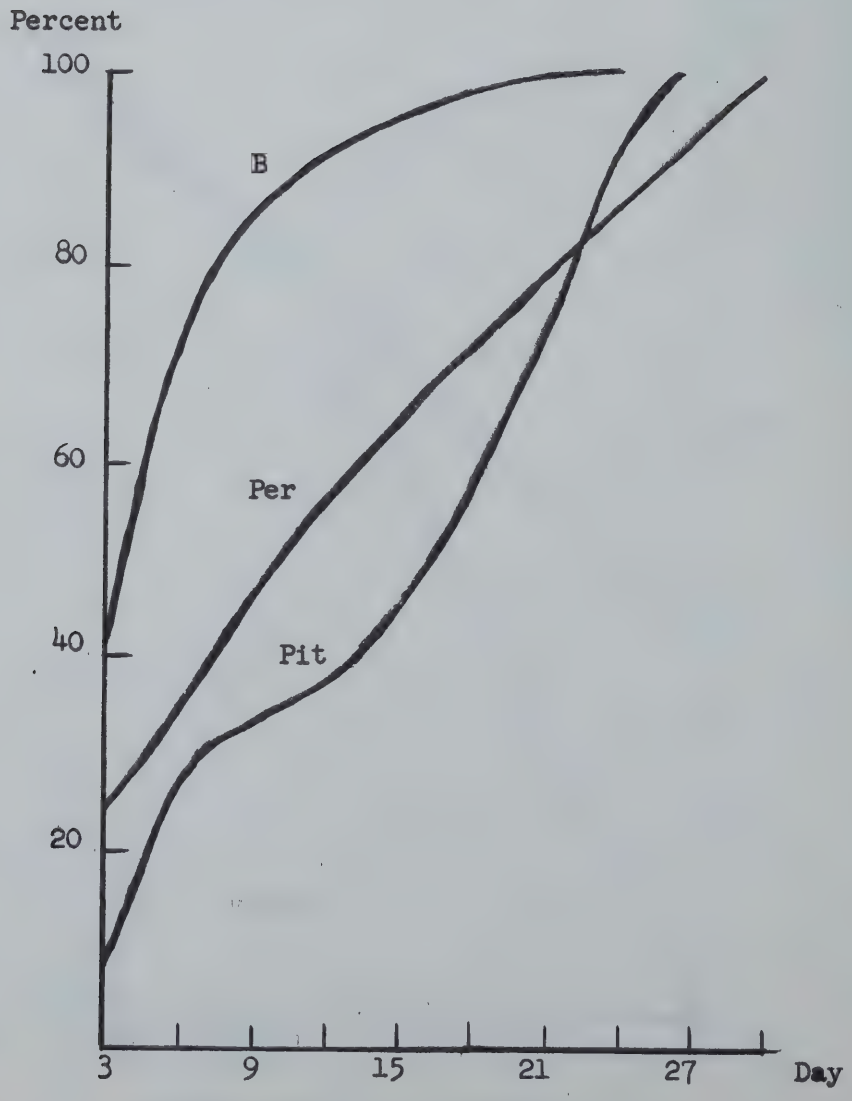



Accumulated % of 30-Day Total

Figure 6

Montgomery County, Md. - 1957
Disturbed Woodlot (10 Acres)
Mr. Andrew Arata

| Genus | Total Catch 3-Day | 30-Day |
|---|---|---|
| B = Blarina | 10 | 25 |
| Per = Peromyscus | 5 | 21 |
| Pit = Pitymys | 2 | 25 |

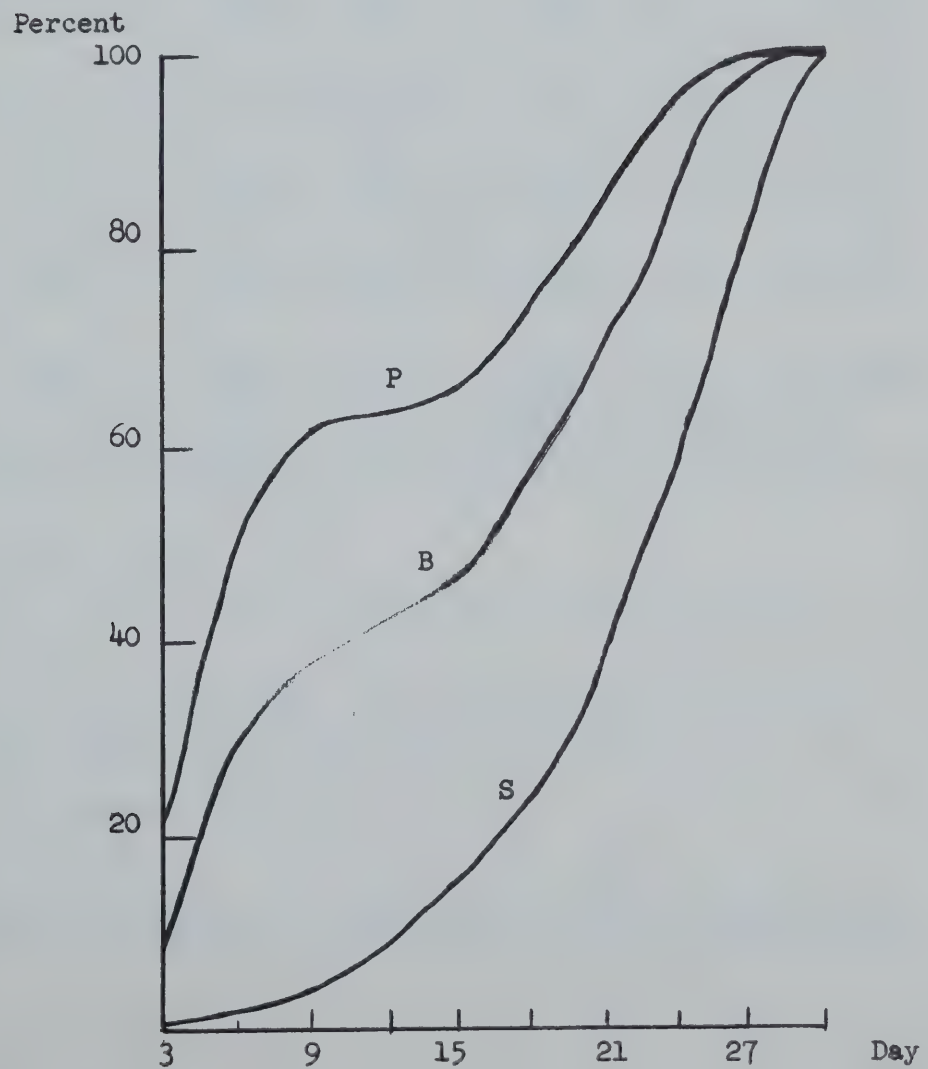



Accumulated % of 30-Day Total

Figure 7

Upland Hardwood
Montgomery County, Md.
(200 + Acres)
Dr. Kyle R. Barbehenn - 1958

| Genus | Total Catch 3-Day | Total Catch 30-Day |
|---|---|---|
| P = Peromyscus | 12 | 57 |
| B = Blarina | 9 | 116 |
| S = Sorex | 0 | 48 |




Accumulated % of 30-Day Total

Comparative Catch of Two Genera in Three Localities

| Location | No. of Lines | Catch by Day (Relative Catch in Parenthesis) 1 | 2 | 3 | Total Days 1-3 | Mean per Line |
|---|---|---|---|---|---|---|
| | | Clethrionomys | | | | |
| New York | 90 | 586 (.408) | 470 (.327) | 380 (.265) | 1436 | 16.0 |
| Alberta | 36 | 117 (.390) | 103 (.338) | 83 (.272) | 305 | 8.5 |
| Maine | 80 | 90 (.489) | 58 (.315) | 36 (.196) | 184 | 2.3 |
| | | Peromyscus | | | | |
| New York | 90 | 93 (.274) | 117 (.344) | 130 (.382) | 340 | 3.8 |
| Alberta | 36 | 241 (.577) | 122 (.292) | 55 (.132) | 418 | 11.6 |
| Maine | 80 | 132 (.434) | 103 (.339) | 69 (.227) | 304 | 3.8 |

In New York (the data of Drs. Webb and Patric) where Clethrionomys considerably exceeded Peromyscus in density, the catch on consecutive days declined for Clethrionomys but increased for Peromyscus. This suggests that the home ranges of Peromyscus were expanding as Clethrionomys were being removed. The immediacy of this response suggests that vocalization-audition is the mode of communication which mediates these social-space relations within and between species in a community.

Where both genera are low in density, as was the case in Maine (Calhoun's data), the continuous and similar decline in catch from days one through three suggests that the members of the two species are too far apart for any inter-generic inhibitory influences to develop to the extent that one species influences the size of the home range of the other.

Withouth a thirty-day continuous removal record available from Alberta (Dr. J. E. Moore's data) one can only guess at the inter-generic social relationship in this locality where both Clethrionomys and Peromyscus were relatively abundant. It will be noted that the rate of decline of Clethrionomys in Alberta was nearly identical to that in New York. Peromyscus, in contrast, exhibited a remarkably rapid rate of decline from days one through three in the Alberta locality. Such a rapid rate of decline might be anticipated where home ranges were relatively small, traps widely dispersed, the species abundant, and no immediate alteration in home range size. One can only suspect that the sum of inter-generic and intra-specific inhibitory "influences" were sufficient that a considerable reduction in the numbers of both species is required before the surviving Peromyscus begin to enlarge their home ranges. Were continuous trapping conducted in the Alberta locality the hypothesis is that a secondary period of increasing catch would appear somewhere between days five and ten.

It is obvious that further data by continous removal trapping is required to provide further insight. In order for results from this type of sampling procedure to be most useful there should be no preceding manipulation which might modify the behavior of individual animals, or which might disrupt the equilibrium of the community. Procedures to be avoided include:

1. Pre-baiting trapping sites
2. Establishing fixed bait stations anywhere in the immediate environment
3. Any live-trapping procedure which is accompanied by exposure-death of a portion of the population
4. Any type of removal trapping

As a general rule the community to be sampled should have experienced no disturbance initiated by the cooperator for at least six months prior to the

thirty-day sampling with the circular trap-line. Since we do not know how long it takes a community to recover its prior equilibrium after such intensive removal trapping it will be best not to repeat a particular trap-line oftner than once a year.

An investigator can establish the pattern of community equilibrium in a particular habitat either by sampling the same locality two or more times (at year intervals) or by simultaneously sampling two or more separate locations. This forms the data which is appropriate for submitting for inclusion in the NACSM releases. Once such patterns of community organization are recognized, the investigator may wish to precede his thirty-day removal sampling by some prior manipulation. Inclusion of such independent variables in a study program will further our general understanding of factors which alter the equilibrium of a community. However, such results are not appropriate for contributing to the NACSM releases but should be considered by the investigator as his primary concern for analysis and publication.

Results of all thirty-day removal censuses utilizing the revised NACSM procedure, conducted during 1959 and 1960, and received not later than December 1960 will be printed and distributed as NACSM release to Cooperators and other interested persons.

Forms for reporting censuses may be procured by writing to:

John B. Calhoun
NACSM Editor
Room 2N-310, Building 10
National Institute of Mental Health
Bethesda 14, Maryland

Where an individual cooperator accumulates an adequate series of data, perhaps also associated with other investigations not reported to the NACSM, it is hoped that each such cooperator will prepare detailed analyses of his study for publication in an appropriate journal.

Distribution of the basic data from all cooperators as NACSM Releases carries the understanding that any investigator may utilize any portions of the reported censuses which are required to complete analyses he wishes to complete and publish. However, such an investigator should in his publication give credit to those cooperators who have provided the results which he used. Such is the basic philosophy of the NACSM cooperative program since many problems, particularly those including comparative objectives, requires the contributions of many persons to provide adequate data.

North American Census of Small Mammals - Forms for reporting census

Cooperator: _____

Address: _____

_____

Location of trapping site: (Note: Should two circular trap-lines be run simultaneously their perimeters should approach no closer than 300 ft. for A type lines or 600 ft. for B type lines) _____

_____

_____

_____

_____

Attempt to locate the trapping site accurately enough so that someone else at a later date may locate the position of the line and, if possible, the stations along the line. A map of the area figuring the location of the lines, if deposited in the NACSM files, will help assure such location.

Prior census designation _____ (List the designation given in the last annual report of the NACSM if this census tract was sampled previously.)

Designation of pattern of sampling

See NACSM Release No. 10 for details of procedure.

| Circular or octagonal trap-line (40 stations, 3 traps per station | | Check type employed |
|---|---|---|
| Type A | 25 ft. between adjoining stations | _____ |
| Type B | 50 ft. between adjoining stations | _____ |

Date traps were first set: _____

Remarks on the weather: Post at the beginning of each day's record on the "Daily Catch Record" forms. _____

_____

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_____

Remarks on the status of the population: _____

_____

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_____

Type of trap _____

Type of bait _____

Location of museum where skins of species recorded in this report are deposited. They should have been taken from some region representative of the area recorded here. _____

_____

(If no skins are vailable for identification in museums from your area, prepare one of an adult specimen for each species and deposit them in the U. S. National Museum if no other museum is preferred.)

Topography of habitat: _____

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If photographs of the habitat are available, insert them in an envelope and attach the envelope here. Do not attach the photographs with stapes or paper clips, since they mar the prints. The larger the photograph, the better printed reproduction will result. All suitable photographs will be published in one of the annual reports as soon as funds are available.

Floristic description of habitat: _____

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Remarks on proximity to differing habitats, agricultural land, etc. (Include here an estimate of the number of acres of continuous habitat within which the trap-line is placed.) _____

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Species taken: (List here the full taxonomic name of each king of animal trapped. When listing the catch on the Daily Catch Record Tables, the genus only needs to be given unless a genus has two species represented, or a species has two sub-species represented.) _____

_____

_____

_____

## Summary of Total Catch by Day of Capture

| Day | Date | Species | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| 30 | | | | | | | | | | | | | | | | | | | |
| Total Days 1 - 30 | | | | | | | | | | | | | | | | | | | |

Daily Catch Record
(List remarks on weather at beginning of each day's record)

| Day | Date | Line | Sta. | Species | Sex | Wt. Gm. | Body mm. | Remarks |
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Note: List stations of capture each day in a clockwise fashion from I-1 to II-20

North American Census of Small Mammals - Forms for reporting census

Cooperator: _____

Address: _____

_____

Location of trapping site: (Note: Should two circular trap-lines be run simultaneously their perimeters should approach no closer than 300 ft. for A type lines or 600 ft. for B type lines) _____

_____

_____

_____

_____

Attempt to locate the trapping site accurately enough so that someone else at a later date may locate the position of the line and, if possible, the stations along the line. A map of the area figuring the location of the lines, if deposited in the NACSM files, will help assure such location.

Prior census designation _____ (List the designation given in the last annual report of the NACSM if this census tract was sampled previously.)

Designation of pattern of sampling

See NACSM Release No. 10 for details of procedure.

| Circular or octagonal trap-line (40 stations, 3 traps per station | | Check type employed |
|---|---|---|
| Type A | 25 ft. between adjoining stations | _____ |
| Type B | 50 ft. between adjoining stations | _____ |

Date traps were first set: _____

Remarks on the weather: Post at the beginning of each day's record on the "Daily Catch Record" forms. _____

_____

_____

_____

Remarks on the status of the population: _____

_____

_____

_____

Type of trap _____

Type of bait _____

Location of museum where skins of species recorded in this report are deposited. They should have been taken from some region representative of the area recorded here. _____

_____

(If no skins are vailable for identification in museums from your area, prepare one of an adult specimen for each species and deposit them in the U. S. National Museum if no other museum is preferred.)

Topography of habitat: _____

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If photographs of the habitat are available, insert them in an envelope and attach the envelope here. Do not attach the photographs with stapes or paper clips, since they mar the prints. The larger the photograph, the better printed reproduction will result. All suitable photographs will be published in one of the annual reports as soon as funds are available.

Floristic description of habitat: _____

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Remarks on proximity to differing habitats, agricultural land, etc. (Include here an estimate of the number of acres of continuous habitat within which the trapline is placed.) _____

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Species taken: (List here the full taxonomic name of each king of animal trapped. When listing the catch on the Daily Catch Record Tables, the genus only needs to be given unless a genus has two species represented, or a species has two subspecies represented.) _____

_____

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_____

## Summary of Total Catch by Day of Capture

| Day | Date | Species | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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